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Atlas Florae Europaeae. Distribution of Vascular Plants in Europe : 17. Rosaceae (Sorbus s. lato)

The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo
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ATLAS FLORAE EUROPAEAE

DISTRIBUTION OF VASCULAR PLANTS IN EUROPE

Rosaceae (Sorbus s. lato)

Edited by

ARTO KURTTO, ALEXANDER N. SENNIKOV & RAINO LAMPINEN

on the basis of team-work of European botanists



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CONTENTS

| | |
|---|-----|
| THE COMMITTEE FOR MAPPING THE FLORA OF EUROPE..... | 4 |
| PREFACE | 7 |
| INTRODUCTION | 10 |
| 1. GRID SYSTEM | 10 |
| 2. STATUS CATEGORIES | 10 |
| 2.1. Mapping symbols and status signs | 10 |
| 3. MAPPING TERRITORIES | 10 |
| 4. TEXT SECTIONS | 11 |
| 5. SPECIAL FEATURES OF VOLUME 17 | 12 |
| 5.1. Order of species | 12 |
| 5.2. Chorological statistics | 12 |
| 5.3. Deviations from Flora Europaea | 13 |
| 5.4. Abbreviations for frequently quoted literature | 17 |
| ROSACEAE (cont.) | 19 |
| <i>Sorbus</i> s. lato | 19 |
| STATUS OF THE TAXA IN THE MAPPING TERRITORIES | 119 |
| ATLAS FLORAE EUROPAEAE NOTES 1–31 | 128 |
| INDEX | 129 |

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PREFACE

The present volume of *Atlas Florae Europaeae* (*AFE*) is the last of the no fewer than five devoted to the Rosaceae, which is, as to the species numbers, among the three largest plant families of Europe. It has taken well over a decade to map the family, which is well known also for its taxonomic complexity principally caused by the high frequency of apomixis.

The relatively long time and great effort of the European botanical community required to finish the mapping of the Rosaceae have already resulted in, for example, the first ever complete sets of maps of the genera *Alchemilla* and *Rubus* on the European scale and in a renaissance of interest in the taxonomy of these and other rosaceous genera. Now we are proud to add *Sorbus s. lato* to the row of plant groups given such an in-depth attention and revision in the mapping. Because of the uncommon complexity of *Sorbus s. lato* and, additionally, an evident need to treat this group as several genera, a particular effort was indeed required to review its nomenclature and taxonomy. As a consequence, it proved necessary to devote a volume of *AFE* to *Sorbus s. lato* alone. Especially our Hungarian, German, Czech and British collaborators have given much of their time and expertise to clear up manifold problems of the group. Alexander Sennikov participated in the research by elucidating taxonomic and nomenclatural problems, also by joint field trips and scientific papers mostly with the Hungarian colleagues. Notably, quite a number of critical articles accompanied the work on this volume, clarifying problems in taxonomy and nomenclature of *Sorbus s. lato* in Central Europe, Scandinavia and the Crimea (*Atlas Florae Europaeae* Notes no. 22–31). The revision culminated in the publication of a phylogenetic checklist of *Sorbus s. lato* in Europe (*Memoranda Soc. Fauna Fl. Fenn.* 93: 1–78. 2017; available at <https://journal.fi/msff/article/view/64741>).

Interspecific hybridization and polyploidy are key processes in plant evolution and are, commonly together with apomixis, responsible for ongoing genetic diversification also in *Sorbus s. lato*. Studies made in the Avon Gorge, England, illustrate well the complexity and evolutionary significance of the mating interrelationships among its taxa. "Diploid taxa are outcrossing and self-incompatible. Triploid taxa are pseudogamous apomicts and generally invariable, but because they also display self-incompatibility, apomictic seed set requires pollen from other taxa of the group – a phenomenon which offers direct opportunities for continuing diversification and evo-

lution through rare sexual hybridization events. In contrast tetraploid taxa are pseudogamous but self-compatible, so they do not have the same obligate requirement for inter-taxon pollination" (Ludwig et al. in *Ann. Bot.* 111: 563–575. 2013).

In Europe, the evolution of *Sorbus s. lato* has been and still is at its hottest in certain regions with especially suitable topographic, climatic and historical circumstances favoring such processes. The most notable of such 'hotspots' for *Sorbus s. lato* diversity and homes to diploid sexual species and polyploid apomictic species are some river valleys (Avon Gorge, Cheddar Gorge, Wye Valley) and Isle of Arran in Britain, Transdanubian and North Hungarian Mountains in Hungary, Slovakia, Bavaria (Bayern) in Germany, and lowlands of southern Norway. Comparable hotspots may well be present also in, at least, the Balkan area, but many parts of Europe still lack detailed inventories of their *Sorbus s. lato* floras. We hope that the present volume of *AFE* may contribute to and inspire more of such inventories, also by bearing evidence of these beautiful trees and shrubs not necessarily being merely a nightmare for taxonomists.

In Europe, *Sorbus s. lato* embraces five sexual diploid species of different phylogenetic origin, each of them classified in separate genera in the present *AFE* volume, with addition of diverse swarms of unstabilized primary hybrids and stabilized hybrid products. Many taxonomists agree that polytopic origin of hybrid products between the same species, morphological heterogeneity of hybrids of the same origin, and apomictic reproduction providing for isolation and maintaining stability of these hybrids justify the recognition of narrowly defined segregates (clones or groups of closely related clones) as taxonomic species. However, various authors consider that apomictic polyploids are not equivalent to Linnaean species and regard them as "microspecies", sometimes even inappropriately lumping them under the same species name by, for example, including them in the closest sexual diploid. We have tried to follow the definition given by Tim Rich and others in their great book *Whitebeams, Rowans and Service Trees of Britain and Ireland* (2010): "..., our ideal species concept for the apomictic *Sorbus* polyploids is that they should be morphologically recognisable entities which are supported by cytological and molecular data, and be monophyletic, biologically successful, obligate apomicts". But, as the authors stated, "unfortunately it is not an ideal world", and we are still far from knowing the es-

essential biological traits of all the taxa recognised as species in the present volume of *AFE*, not to mention (other) units potentially meeting the requirements defined above.

Many accepted species of *Sorbus* s. lato are very narrowly distributed and therefore require protection in Europe. A special project has been undertaken within the frames of the Global Tree Assessment, an initiative of Botanic Gardens Conservation International, to produce European Red List assessments of all species of *Sorbus* s. lato according to the criteria of the International Union for Conservation of Nature (IUCN). *AFE* contributed actively to this project with distributional data and field observations, thus taking part not only in documenting plant diversity but also in saving it, which is highly important in our times of rapid climate change and increasing anthropogenous pressure. All European assessments of *Sorbus* s. lato have been published recently by the IUCN.

Sorbus s. lato was considered a single polymorphic genus by most of botanists until the phylogenetic era, although several attempts of splitting resulted in naming of all major components of this group as separate genera already by mid-19th century. Then the phylogenetic analyses of *Sorbus* s. lato revealed that this group is not monophyletic and consists of five primary lineages, which are more closely related to other genera traditionally recognised in the tribe Malinae. Thus, in phylogenetic analyses *Sorbus aucuparia* (*Sorbus*) and *S. domestica* (*Cormus*) were grouped together with *Pyrus*, whereas *S. aria* (*Aria*), *S. chamaemespilus* (*Chamaemespilus*) and *S. torminalis* (*Torminalis*) appeared to be related with a group containing *Aronia*, *Cydonia* and other small genera. These discoveries were reflected in taxonomic cassifications by Kenneth R. Robertson, James B. Phipps and followers, which were developed originally on morphological grounds and then supported by phylogenies, but not followed in taxonomic monographs and regional revisions which continued using the broad generic concept because of the greatest number of accepted taxa being of intergeneric origin.

The intergeneric hybridization in *Sorbus* s. lato is very uneasy to interpret taxonomically. Firstly, Robertson et al. (Syst. Bot. 16: 381. 1991) noted that the intergeneric hybridization in Malinae does not indicate possible evolutionary relationships but rather reflects weak barriers to hybridization, which is a phenomenon found in the whole tribe. Secondly, a common ease for making hybrids between *S. aria* s. lato and *S. torminalis*, *S. aucuparia* and *S. chamaemespilus*, along with the capability for backcrossing, may make a distinction between the species and their hybrids rather difficult. Since the main evolutionary lineages in *Sorbus* s. lato are morphologically and phylogenetically distinct, we adopt the monophyletic classification of Malinae and recognise both primary lineages and their hybridogeneous descendants at the level of genera.

The intergeneric hybrids in *Sorbus* s. lato were rarely classified in segregate genera. Recently, Mezheny (Rare Fruit Crops: 1–80. 2012) volunteered to supply nothoge-

neric names for these hybridogeneous segregates which, however, are not appropriate under formal rules of botanical nomenclature when hybrids are treated as hybridogeneous taxa. For this reason the hybridogeneous generic segregates have been named anew in order to produce the phylogenetic synopsis of *Sorbus* s. lato mentioned above. Numerous new combinations at the rank of species had to be proposed, too, to move species to segregate genera or to recognise priority of species epithets there.



With great regret, we announce the demise of several persons, whose contributions to *AFE* have been of great importance: Pedro Montserrat Recoder (8.8.1918–4.2.2017), one of the "padres" of the Instituto Pirenaico de Ecología in Jaca, "a tireless worker" and "a dreamer and a practical man who wanted to contribute to the sustainable development of the rural world", worked for Vols. 1–15 as an *AFE* collaborator for Spain and from Vol. 11 as an advisor of *AFE*; Asuman Baytop (27.3.1920–18.2.2015), "a cultured and courteous lady, always with a warm welcome for those on study visits to the ISTE herbarium" (Brian Mathew), worked for Vols. 6–13 as an *AFE* collaborator for Turkey; Volodymyr I. Chopyk (Vladimir Ivanovich Chopik) (4.6.1929–3.12. 2015), who worked more than four decades for the *AFE* as a leading collaborator for Ukraine; Hans Runemark (7.1.1927–11.12.2014), who worked for Vols. 1–11 as *AFE* assistant collaborator and data provider for the Aegean Islands (Greece); Stefan Ericsson (13.11.1954–26.1.2015), a versatile and industrious naturalist and an internationally recognised expert in difficult plant groups like *Alchemilla* and the *Ranunculus auricomus* aggregate, worked from Vol. 6, i.e. more than three decades, as an *AFE* collaborator for Sweden and as a taxonomic expert for the *Alchemilla* volume of *AFE*; Pavel V. Kulikov (29.7.1964–28.9.2014), with a great knowledge in the flora of the Ural Mountains, actively contributed to *AFE* for Vols. 14–16. Rudolf V. Kamelin (12.8.1938–1.4.2016), a highly esteemed Russian botanist, participated in the mapping of *Potentilla* s. lato in *AFE* 13 both as a taxonomic expert and data provider. Pekka Isoviita (12.1.1931–7.2.2016), well-known as an expert in botanical nomenclature and bryophyte taxonomy and a Member of the Finnish Consultative Committee in 1971–1999 (Vols. 1–12), had during his years as Director of the Botanical Museum of the University of Helsinki in 1992–1994 an important role in negotiations with the university on more permanent funding for *AFE*.

Christopher D. Preston (Abbots Ripton), a collaborator for the British Isles from Vol. 6 onwards, has retired from *AFE*. He did very long and active career for *AFE* in his countries. Gertrude Gavrilova (Salaspils), first an assistant collaborator for the U.S.S.R. (Vol. 7 and Vol. 8) and then a collaborator for Latvia since Vol. 12, and Helena Šipošová, a collaborator for Slovakia since Vol. 13, have retired from *AFE*, too. Their active participation in the mapping team is also highly appreciated.

In the preparation of the present *AFE* volume, Arto Kurtto bore the main responsibility for writing the taxon texts and most of the *Introduction*, as well as corresponding with the regional collaborators, in which Sennikov was of great help especially as regards the collaborators in East Europe. The nomenclatural checklist, which served as a backbone for mapping, is a common responsibility of these authors. Sennikov also helped in proofreading, as well as in nomenclatural and taxonomic matters. Raino Lampinen is responsible for cartographic matters and production of the final maps.

The preparation of the present volume followed as they are the guidelines and principles adopted in Vol. 13, with the clarification of principles and amendment of the methods realized in Vol. 14. Maps in this volume are based on data submitted on or before 1 September 2017. All of the additions to the distribution data of any territory made by the editors or other persons indicated in the entries titled *Additional material provided by* in the list of collaborators are properly documented in the *AFE* database and will be available to the relevant regional collaborators on request. The same holds for the changes made by the editors to the original datasets supplied by the regional collaborators.

All those involved in the preparation of this volume deserve our gratitude. Compilation of the maps was, naturally, only possible due to the efforts of a large number of regional collaborators and their assistants, as well as persons submitting additional data to them or directly to the editors. The Finnish Museum of Natural History (*FMNH*) provided funds to the *AFE* Secretariat for travel expenses.

Our cordial thanks are due to Leena Helynranta for her indispensable and skilful realization of the layout, as well

as for acting as the liaison with the printing house, and to Sirkka Sällinen for her patient help with the endless acquisition of relevant literature. It is a pleasure to thank Dr. Alan Morton (Winkfield, Windsor); the final maps were produced using the DMAP for Windows created by him. We thank Heikki Kalliomaa, Espoo, for design of the cover, and Marja Koistinen, Helsinki, for the cover illustrations.

The work for the present volume of *AFE* has been made possible by the full support from *FMNH* (led by Prof. Leif Schulman) and from its Botany Unit (led by Dr. Marko Hyvärinen). However, in these economically difficult days the financing of the Secretariat of this important international programme solely by the *FMNH* becomes more and more challenging and novel ways to maintain the work must evidently be sought and found.

We hope that the present volume is of value both to those especially interested in the woody Rosaceae and to the botanical community in general. Now we indeed leave the mapping of the Rosaceae for *AFE* and concentrate on the next challenge. It is another large family, the Leguminosae, or Fabaceae, which, however, may prove easier to map than the Rosaceae due to the rarity of apomixis and to the extensive modern studies on the taxonomy and phylogeny of its numerous genera. The first of the *AFE* volumes covering the Fabaceae is already well on the way, and the draft text of the second one was distributed in June 2017.

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